TỔNG LIÊN ĐOÀN LAO ĐỘNG VIỆT NAM
TRƯỜNG ĐẠI HỌC TÔN ĐỨC THẮNG
KHOA CÔNG NGHỆ THÔNG TIN

BÁO CÁO GIỮA KÌ MÔN CẤU TRÚC RỜI RẠC

Người hướng dẫn: **TS NGUYỄN THỊ HUỲNH TRÂM**

Người thực hiện: **NGUYỄN TÔN ĐIỀN - 52000643**

Lớp **: 20050201**

Khoá **: 24**

THÀNH PHỐ HỒ CHÍ MINH, NĂM 2021

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ĐỒ ÁN ĐƯỢC HOÀN THÀNH
TẠI TRƯỜNG ĐẠI HỌC TÔN ĐỨC THẮNG

Tôi xin cam đoan đây là sản phẩm đồ án của riêng tôi và được sự hướng dẫn của TS Nguyễn Thị Huỳnh Trâm. Các nội dung nghiên cứu, kết quả trong đề tài này là trung thực và chưa công bố dưới bất kỳ hình thức nào trước đây. Những số liệu trong các bảng biểu phục vụ cho việc phân tích, nhận xét, đánh giá được chính tác giả thu thập từ các nguồn khác nhau có ghi rõ trong phần tài liệu tham khảo.

Ngoài ra, trong đồ án còn sử dụng một số nhận xét, đánh giá cũng như số liệu của các tác giả khác, cơ quan tổ chức khác đều có trích dẫn và chú thích nguồn gốc.

Nếu phát hiện có bất kỳ sự gian lận nào tôi xin hoàn toàn chịu trách nhiệm về nội dung đồ án của mình. Trường đại học Tôn Đức Thắng không liên quan đến những vi phạm tác quyền, bản quyền do tôi gây ra trong quá trình thực hiện (nếu có).

TP. Hồ Chí Minh, ngày 11 tháng 11 năm 2021

Tác giả

(ký tên và ghi rõ họ tên)

Nguyễn Tôn Điền

PHẦN XÁC NHẬN VÀ ĐÁNH GIÁ CỦA GIẢNG VIÊN

Phần xác nhận của GV hướng dẫn

Tp. Hồ Chí Minh, ngày tháng năm
(kí và ghi họ tên)

Phần đánh giá của GV chấm bài

Tp. Hồ Chí Minh, ngày tháng năm
(kí và ghi họ tên)

TÓM TẮT

Bản báo cáo này giúp ôn lại những kiến thức của chương 1 môn Cấu trúc rời rạc. Bản báo cáo có 2 phần chính là phần 1 và phần 2:

Phần 1 gồm có: Câu đố đi tìm mật khẩu, Conditional Statement và Fallacies

Phần 2 gồm có: Tarki’s World, Symbolic form, và Equivalence.

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CHƯƠNG 1 – PART 1

1.1 Problem 1: Password

A hacker is trying to hack a password. He knows that this password has 3 characters, each of which is a distinct number from 1 to 9. He also learns from his trials:

a. 472: one number is correct but in an incorrect position.

b. 581: one number is correct but in an incorrect position.

c. 483: one number is correct and in the correct position.

d. 317: two numbers are correct but in incorrect positions.

e. 956: all numbers are incorrect.

Please help him to find the password with good reasoning.

Solution for problem 1:

Gọi 3 chữ số lần lượt từ trái qua phải là x1, x2, x3

Theo đề, x1, x2, x3 là các số từ 1 đến 9 và phải phân biệt

Theo giả thiết e, các chữ số 9, 5, 6 đều sai nên x1, x2, x3 chỉ có thể là: 1, 2, 3, 4, 7, 8

Theo giả thiết b, c, ta có thể loại số 8, bởi giả sử số 8 là số ta cần tìm thì theo giả thiết c, x2 là số 8 mà câu b lại mâu thuẫn khi khẳng định nếu mật khẩu có số 8 thì nó không thể nằm ở vị trí x2

Do đó, x1, x2, x3 chỉ còn có thể là: 1, 2, 3, 4, 7

Theo giả thiết a, c, ta có thể loại số 4, bởi giả sử số 4 là số ta cần tìm thì theo giả thiết c, x1 là số 4 mà giả thiết a lại mâu thuẫn khi khẳng định nếu mật khẩu có số 4 thì nó không thể nằm ở vị trí x1

Do đó, x1, x2, x3 chỉ còn có thể là: 1, 2, 3, 7. Theo giả thiết b, ta có thể suy ra 1 là số nằm trong mật khẩu nhưng chú ý 1 không nằm ở vị trí x3; theo giả thiết c, ta có thể suy ra x3 là 3 (*).

Theo giả thiết d, có 2 số đúng nằm trong mật khẩu và ta đã tìm được số 1 và số 3 (từ *), chính vì thế ta loại số 7.

Do đó, x1, x2, x3 chỉ còn có thể là: 1, 2, 3. Ta tìm thứ tự của chúng:

Ta có đáp án x3 là số 3 (từ *); theo giả thiết d, x2 không thể là số 1 chính vì thế x1 là số 1; x2 là số 2 (vị trí còn lại)

Vậy mật khẩu cần tìm là 123.

1.2 Problem 2: Conditional statement

a. "If a man, holding a belief which he was taught in childhood or persuaded of afterwards, keeps down and pushes away any doubts which arise about it in his mind, purposely avoids the reading of books and the company of men that call in question or discuss it, and regards as impious those questions which cannot easily be asked without disturbing it - *the life of that man is one long sin against mankind."*

The Ethics of Belief (1877) by William K. Clifford

p: a man, holding a belief which he was taught in childhood or persuaded of afterwards, keeps down and pushes away any doubts which arise about it in his mind, purposely avoids the reading of books and the company of men that call in question or discuss it, and regards as impious those questions which cannot easily be asked without disturbing it

q: the life of that man is one long sin against mankind.

~p: a man, holding a belief which he was taught in childhood or persuaded of afterwards, does not keep down and push away any doubts which arise about it in his mind, purposely avoid the reading of books and the company of men that call in question or discuss it, and regard as impious those questions which cannot easily be asked without disturbing it

~q: the life of that man is not one long sin against mankind.

Original form: p->q

- Converse: q -> p

If the life of a man is one long sin against mankind, then he who is holding a belief which he was taught in childhood or persuaded of afterwards, keeps down and pushes away any doubts which arise about it in his mind, purposely avoids the reading of books and the company of men that call in question or discuss it, and regards as impious those questions which cannot easily be asked without disturbing it.

- Inverse: ~p -> ~q

If a man, holding a belief which he was taught in childhood or persuaded of afterwards, does not keep down and push away any doubts which arise about it in his mind, purposely avoid the reading of books and the company of men that call in question or discuss it, and regard as impious those questions which cannot easily be asked without disturbing it - the life of that man is not one long sin against mankind

- Contrapositive: ~q -> ~p

If the life of a man is not one long sin against mankind, then he who is holding a belief which he was taught in childhood or persuaded of afterwards, does not keep down and push away any doubts which arise about it in his mind, purposely avoid the reading of books and the company of men that call in question or discuss it, and regard as impious those questions which cannot easily be asked without disturbing it.

- Non-conditional-form negation: p ∧ ~q

A man, holding a belief which he was taught in childhood or persuaded of afterward, keeps down and pushes away any doubts which arise about it in his mind, purposely avoids the reading of books and the company of men that call in question or discuss it, and regards as impious those questions which cannot easily be asked without disturbing it and the life of that man is not one long sin against mankind.

b. "If existing agricultural knowledge were everywhere applied, the planet could feed twice its present population."

The Lessons of History (1968) by Will and Ariel Durant.

p: existing agricultural knowledge were everywhere applied

q: the planet could feed twice its present population

~p: existing agricultural knowledge were not everywhere applied

q: the planet could not feed twice its present population

Original form: p -> q

- Converse: q -> p

If the planet could feed twice its present population, existing agricultural knowledge would be everywhere applied.

- Inverse: ~p -> ~q

If existing agricultural knowledge were not everywhere applied, the planet could not feed twice its present population.

- Contrapositive: ~q -> ~p

If the planet could not feed twice its present population, existing agricultural knowledge would not be everywhere applied.

- Non-conditional-form negation: p ∧ ~q

Existing agricultural knowledge were everywhere applied, and the planet could not feed twice its present population.

c. "But even if the initial colonists had consisted of only 100 people and their numbers had increased at a rate of only 1.1 percent per year, the colonists' descendants would have reached that population ceiling of 10 million people within a thousand years."

Guns, Germs, and Steel (1997) by Jared Diamond.

p: The initial colonists had consisted of only 100 people

q: Their numbers had increased at a rate of only 1.1 percent per year

r: The colonists’ descendants would have reached that population ceiling of 10 million people within a thousand years

~p: The initial colonists had not consisted of only 100 people

~q: Their numbers had not increased at a rate of only 1.1 percent per year

~r: The colonists’ descendants would not have reached that popylation ceiling of 10 million people within a thousand years

Original form: (p ∧ q) -> r

- Converse: r -> (p ∧ q)

If the colonists’ descendants have reached that population ceiling of 10 million people within a thousand years, then the initial colonists would have had consisted of only 100 people and their numbers would have had increased at a rate of only 1.1 percent per year.

- Inverse: ~(p ∧ q) -> ~r ≡ (~p ∨ ~q) -> ~r

But even if the initial colonists had not consisted of only 100 people or their numbers had not increased at a rate of only 1.1 percent per year, the colonists’ descendants would not have reached that population ceiling of 10 million people within a thousand years.

- Contrapositive: ~r -> ~(p ∧ q) ≡ ~r -> (~p ∨ ~q)

If the colonists’ descendants have not reached that population ceiling of 10 million people within a thousand years, then the initial colonists would not have had consisted of only 100 people or their numbers would not have had increased at a rate of only 1.1 percent per year.

- Non-conditional-form negation: (p ∧ q) ∧ ~r

But even if the initial colonists had consisted of only 100 people and their numbers had increased at a rate of only 1.1 percent per year, and the colonists’ descendants would not have reached that population ceiling of 10 million people within a thousand years.

d. "If anyone looked out of their window now, even beady-eyed Mrs. Dursley, they wouldn't be able to see anything that was happening down on the pavement."

Harry Potter and the Philosopher's Stone (1997) by J. K. Rowling

p: anyone looked out of their window now, even beady-eyed Mrs. Dursley

q: they wouldn't be able to see anything that was happening down on the pavement.

~p: anyone did not look out of their window now, even beady-eyed Mrs.Dursley

~q: they would be able to see anything that was happening down on the pavement.

Original form: p -> q

- Converse: q -> p

If anyone, even beady-eyed Mrs. Dursley, is not able to see anything that was happening down on the pavement, then they would look out of their window now.

- Inverse: ~p -> ~q

If anyone did not look out of their window now, even beady-eyed Mrs. Dursley, they would be able to see anything that was happening down on the pavement.

- Contrapositive: ~q -> ~p

If anyone, even beady-eyed Mrs.Dursley, is able to see anything that was happening down on the pavement, then they would not look out of their window now.

- Non-conditional-form negation: p ∧ ~q

Anyone looked out of their window now, even beady-eyed Mrs. Dursley and they are able to see anything that was happening down on the pavement.

1.3 Problem 3: Fallacies

- Converse Error:

If the traffic signal is red, then cars stop.

Quora (2016) by Umang Ahuja from (1)

Cars stop

• The traffic signal is red

- Inverse Error:

If it is raining outside, you do not have to water the plant by yourself.

Quora (2016) by Indra Bhattacharya from (1)

It is not raining outside

• You have to water the plant by yourself

- A Valid Argument with a False Premises and a False Conclusion

If Hillary Clinton is the president of the USA, then Hillary Clinton is younger than 35.

Unknown Author from (2)

Hillary Clinton is the president of USA.

• Hillary Clinton is younger than 35.

- An Invalid Argument with True Premises and a True Conclusion

If Tokyo is a big city, then Tokyo has tall buildings.

Discrete Structures (2015) by Aaron Tan

Tokyo has tall buildings

• Tokyo is a big city

- Unsound Argument

All dogs are brown.

Corki is a dog.

• Corki is brown

Unknown Author from (3)

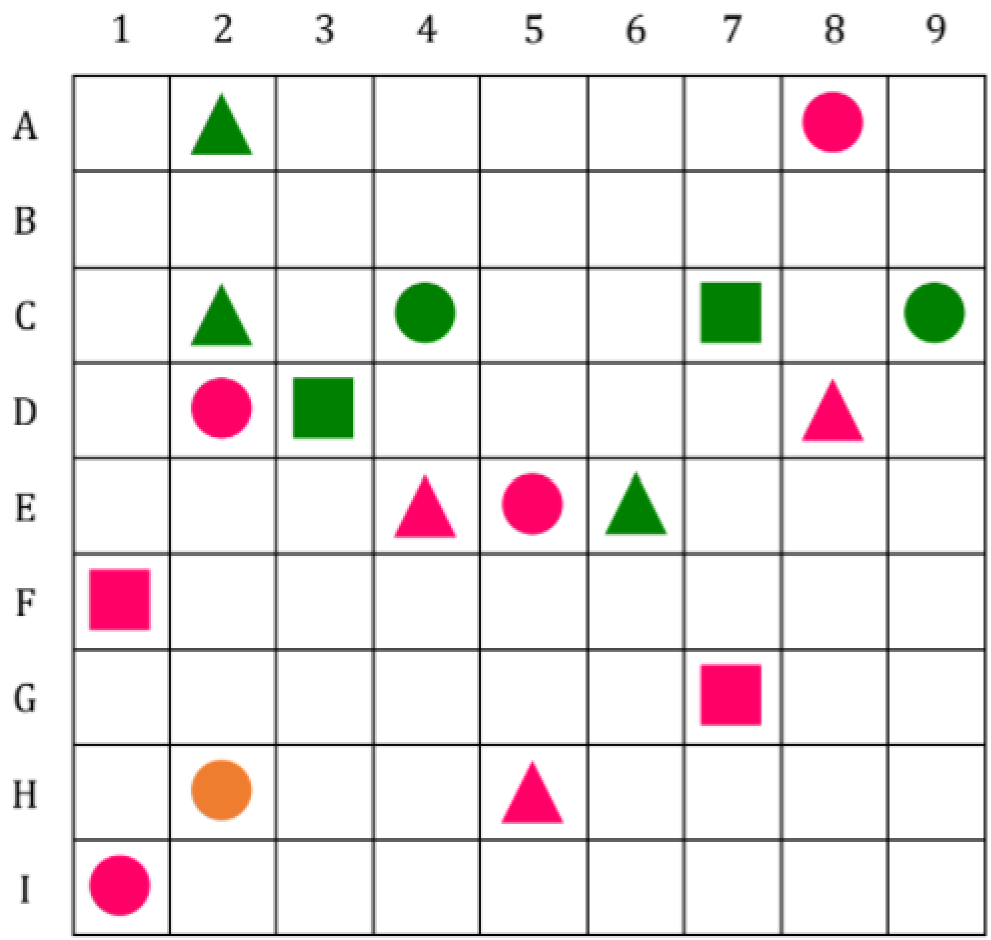
CHƯƠNG 2 – PART 2

Lưu ý: MSSV của em là 52000643 thế nên 643 là con số định danh đề.

2.1 Problem 4: Tarski's world

(643 % 7 = 6, change the item at E6 into a green triangle)

a. After modified the above Tarski's world



Hình 2.1. Modified Tarski's world

b. Determine the truth or falsity of all the following statements, based on the modified Tarski's world. Give the reasons for your justification.

i. *∀x, Circle(x) → Green(x)* is **false** because:

Negated statement: ∃x such that, Circle(x) ∧ ~ Green(x)

We can find that the circle at D2 is red (not green), which means the negated statement is correct, so the original statement is false.

ii. *∀x, Triangle(x) → ~Orange(x)* is **true** because:

Negated statement: ∃x such that, Triangle(x) ∧ Orange(x)

We cannot find any triangle that is orange, which means the negated statement is incorrect, so the original statement is true.

iii. *∃x such that Red(x) ∧ Triangle(x)* is **true** because:

We can find that there is a red triangle at E4.

iv. *∃x such that ~Green(x) ∧ BelowOf(x, E4)* is **true** because:

We can find that there is a red (not green) and below of E4 at F1.

v. *∀x, Square(x) → RightOf(E5, x)* is **false** because:

Negated statement: ∃x such that Square(x) ∧ ~ RightOf(E5, x)

We can find that there is a square at C7 is to the right of E5, which means that E5 is not to the right of that square (the negated statement is correct), so the original statement is false.

vi. *∃x such that AboveOf(E5, x) ∧ LeftOf(x, E5)* is **true** because:

We can find that F1 is below and to the left of E5.

vii. *There is a triangle x such that for all squares y, x is above y*. This statement is **true** because:

Formal form: ∃Triangle(x) such that, ∀Square(y), AboveOf(x,y)

We can find that there is a triangle at A2 that is to above of every squares

viii. *For all circles x, there is a square y such that y is to the right of x*. This statement is **false** because:

Formal form: ∀Circle(x), ∃Square(y), RightOf(y,x)

Negated formal form: ∃ Circle(x), ∀ Square(y), ~ RightOf(y,x)

We can find that there is a circle at C9 such that all squares are not to the right of that circle, which means the negated statement is correct, so the original statement is false.

ix. *There is a circle x and there is a square y such that y is below x*. This statement is **true** because:

Formal form: ∃ Circle(x) ∧∃ Square(y), BelowOf(y,x)

We can find that there is a square at C7 that is to below of a circle at A8.

x. *For all circles x and for all triangles y, x and y have the same color*. This statement is **false** because:

Formal form: ∀Circle(x) ∧ ∀ Triangle(y), x and y have the same color

Negated formal form: ∃ Circle(x) ∨ ∃ Triangle(y), x and y do not have the same color

We can find that there is a green triangle at A2, or a red circle at A8 (they do not have the same color), which means the negated statement is correct, so the original statement is false.

2.2 Problem 5: Symbolic form

Let p = "it is windy"; q = "it is thundering"; r = "it is raining"; s = "it is lightning"

There are some statements:

a. It is windy, but it isn't raining.

b. It is windy, thundering but it isn't raining.

c. It is raining without thundering and lightning.

d. Windiness is a necessary condition for rain.

e. Windiness is a sufficient condition for rain.

f. Whenever it is lightning, it will be thundering.

g. The necessary and sufficient condition for thundering is lightning.

Using p, q, r, and logical connectives to write the symbolic form of b, c, e, g

(Vì 643 % 2 = 1 nên em sẽ làm câu b, c, e, g)

Solution for Problem 5:

b. $(p \wedge q) \wedge \sim r$

c. $r \wedge \sim(q \vee s)$

e. $p \rightarrow r$

g. $s \leftrightarrow q$

2.3 Problem 6: Equivalence

Let p, q, r be statement variables. Prove that the following pair of statements are logically equivalent by 2 methods: (i) using truth table; and (ii) using logical equivalence laws. (Because 643%3 = 1 so I need to prove):

$\sim [(\sim p \vee q) \vee \sim (p \wedge \sim (p \vee q))] \equiv p \wedge \sim (p \vee q)$

Solution for Problem 6:

Using logical equivalence

$\sim [(\sim p \vee q) \vee \sim (p \wedge \sim (p \vee q))]$	
$\equiv \sim (\sim p \vee q) \wedge (p \wedge \sim (p \vee q))$	De Morgan's Law
$\equiv (p \wedge \sim q) \wedge (p \wedge \sim p \wedge \sim q)$	De Morgan's Law
$\equiv (p \wedge p) \wedge \sim p \wedge (\sim q \wedge \sim q)$	Associative Law
$\equiv p \wedge \sim p \wedge \sim q$	Idempotent Law
$\equiv p \wedge \sim[\sim(\sim p \wedge \sim q)]$	Associative and Double Negative Laws
$\equiv p \wedge \sim(p \vee q)$	De Morgan's Law

Using truth table

p	q	C1 = (~ p ∨ q)	C2 = (p ∨ q)	C3 = (p ∧ ~ C2)	~ (C1 ∨ ~C3)	p ∧ ~ C2
F	F	T	F	F	F	F
F	T	T	T	F	F	F
T	F	F	T	T	F	F
T	T	T	T	F	F	F

Bảng 2.1 Truth table for problem 6

Look at the last 2 columns we can conclude that:

$\sim [(\sim p \vee q) \vee \sim (p \wedge \sim (p \vee q))] \equiv p \wedge \sim (p \vee q)$

TÀI LIỆU THAM KHẢO

(1) Quora (2016), by Umang Ahuja, Indra Bhattacharya https://www.quora.com/Can-any-one-give-a-real-life-example-of-if-else-and-nested-if-else-or-any-others-like-switch-cases, accessed on 11/11/2021 using Opera.

(2) Unknown Author, https://academic.csuohio.edu/polen/LC9_Help/1/14ffv.htm, accessed on 11/11/2021 using Opera.

(3) Unkown Author, https://www.differencebetween.com/difference-between-sound-and-unsound-argument/, accessed on 11/11/2021 using Opera.